ARI Research Note 87-74

ARI-POM DATABASE DEVELOPMENT PLAN

Jack Briscoe
The BDM Corporation

for

Contracting Officer's Representative
Nancy Atwood

ARI Field Unit at Presidio of Monterey, California
Howard H. McFann, Chief

TRAINING RESEARCH LABORATORY
Jack H. Hiller, Director

U. S. Army

Research Institute for the Behavioral and Social Sciences

December 1987

U. S. ARMY RESEARCH INSTITUTE

FOR THE BEHAVIORAL AND SOCIAL SCIENCES

A Field Operating Agency under the Jurisdiction of the

Deputy Chief of Staff for Personnel

EDGAR M. JOHNSON
Technical Director

WM. DARRYL HENDERSON
COL, IN
Commanding

Research accomplished under contract
for the Department of the Army

The BDM Corporation

Technical review by

Nathaniel Speight

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE

ADA190586

REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION: Unclassified	1b. RESTRICTIVE MARKINGS: n/a
2a. SECURITY CLASSIFICATION AUTHORITY: n/a	3. DISTRIBUTION/AVAILABILITY OF REPORT: Approved for public release; distribution unlimited.
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE: n/a	
4. PERFORMING ORGANIZATION REPORT NUMBER(S): BDM/ARI-TR-0085-87	5. MONITORING ORGANIZATION REPORT NUMBER(S): ARI Research Note 87-74
6a. NAME OF PERFORMING ORGANIZATION: The BDM Corporation; 6b. OFFICE SYMBOL (If applicable):	7a. NAME OF MONITORING ORGANIZATION: ARI Field Unit at Presidio of Monterey, California
6c. ADDRESS (City, State, and ZIP Code): 2600 Garden Road, North Building, Monterey, CA 93940	7b. ADDRESS (City, State, and ZIP Code): P.O. Box 5787, Presidio of Monterey, CA 93944
8a. NAME OF FUNDING/SPONSORING ORGANIZATION: U.S. Army Research Institute; 8b. OFFICE SYMBOL (If applicable): PERI-IO	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER: MDA903-85-C-0472
8c. ADDRESS (City, State, and ZIP Code): 5001 Eisenhower Avenue, Alexandria, VA 22333	10. SOURCE OF FUNDING NUMBERS: PROGRAM ELEMENT NO. 6.37.43.A; PROJECT NO 202637 43A794; TASK NO 5.1.1; WORK UNIT ACCESSION NO. 5.1.1.C.1

11. TITLE (Include Security Classification): ARI-POM DATABASE DEVELOPMENT PLAN

12. PERSONAL AUTHOR(S): Jack Briscoe

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
ARI Research Note	FROM 3-86 TO 2-87	1987, December	12

16. SUPPLEMENTARY NOTATION: Nancy Atwood, contracting officer's representative

17. COSATI CODES		
FIELD	GROUP	SUB-GROUP

18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number): Database Development; Database Systems; Army Research Institute (ARI); National Training Center (NTC); Presidio of Monterey (POM)

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

This research note presents a plan for the development of an enhanced NTC database system for the Army Research Institute's Presidio of Monterey Field Unit. It lays out a series of four steps, each with a deliverable, or set of deliverables, which should result in an NTC database system that will support the research requirements of ARI-POM, and of the NTC research community for the forseeable future.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT	21. ABSTRACT SECURITY CLASSIFICATION
☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS	Unclassified

22a. NAME OF RESPONSIBLE INDIVIDUAL	22b. TELEPHONE (Include Area Code)	22c. OFFICE SYMBOL
Nancy K. Atwood	408/647-5316	PERI-IOB

DD Form 1473, JUN 86 — Previous editions are obsolete.

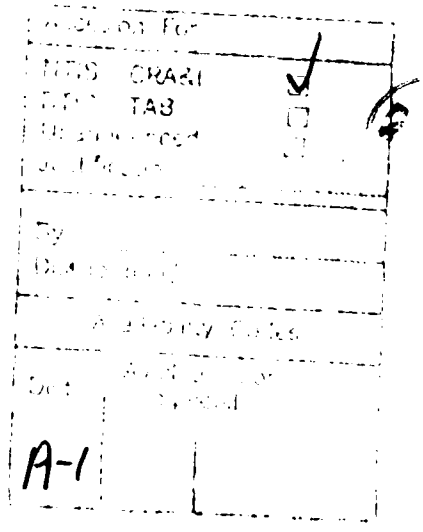
SECURITY CLASSIFICATION OF THIS PAGE

UNCLASSIFIED

ARI-POM NTC DATABASE DEVELOPMENT PLAN

CONTENTS

LIST OF FIGURES



1.0 Introduction

This document is a plan for the development of an enhanced NTC database system for the Army Research Institute - Presidio of Monterey. It lays out a series of four steps, each with a deliverable (or set of deliverables), resulting in an NTC database system that will support the research requirements of ARI-POM and the NTC research community for the foreseeable future. Figure 1.1 shows the steps, gives a very brief summary of the included activities, and lists the deliverables.

2.0 Background

The database that will be designed is the second database developed specifically for ARI-POM to conduct research based on NTC data. The original NTC Database Research System (NTCDRS), designed and developed by SAI, was delivered in 1984. During the course of the past 16 months, several shortcomings of the NTCDRS have been identified and documented. The problems fall into two main categories:

(1) The NTCDRS design does not support current ARI-POM research goals. This is primarily because NTCDRS specification, design, and development occurred prior to the emergence of issues and research goals now considered important. Several of the database tables which exist in the NTCDRS serve no discernable purpose, while useful information is missing from other tables. The current table structure is also awkward to use, primarily because of poor design of the table interrelationships.

(2) The NTCDRS does not work as designed. Several modifications and workarounds have been incorporated simply to allow normal NTCDRS production.

Events of the past 16 months have demonstrated that there is a great deal of interest by the US Army training community in conducting research based on NTC data. Because NTCDRS is clearly inadequate to support the kinds of efforts proposed, the development of a new NTC database system is required.

Phase	Activities	Products
Specification	Determine User Requirements; Document Baseline Specifications	1-NTC Data Handbook (draft) 2-Database Specification
Preliminary Design (PDR)	Allocate Requirements to functions; Finalize data structures and relationships	1-NTC Data Handbook (Final) 3-Preliminary Design Document
Detailed Design (CDR)	Generate detailed pseudo-code for all software functions	4-Detailed Design 5-Draft Users' Guide
Code, Debug	Translate pseudo-code to high-level language, test	5-Users' Guide 6-Database System 7-Training Products

NTC Database Development

Figure 1.1

3.0 Approach to Developing an NTC Database

The proposed approach can be stated as a series of four tasks leading to a completed database system. The four tasks are:

(1) Develop comprehensive design specifications for a database system that will support research based on NTC data. The goal of the specification phase is the documentation of specific data elements and relationships to be incorporated in the enhanced data base.

(2) The second task is the development of the preliminary software design for the software which will create the NTC database as well as the user interface to the system. The completion of the preliminary design, coinciding with a Preliminary Design Review (PDR), constitutes a necessary "freeze" on the database design in order to allow completion of the detailed design and implementation without delay, and without corrupting the basic design of the system.

(3) The final step preparatory to coding is the detailed design, which includes the generation of pseudo code for all modules, as well as implementation of all data structures in the target language.

(4) The final developmental step is the translation of the pseudo code generated in the detailed design to target language code, integrating the code with the data structures, and testing the completed system.

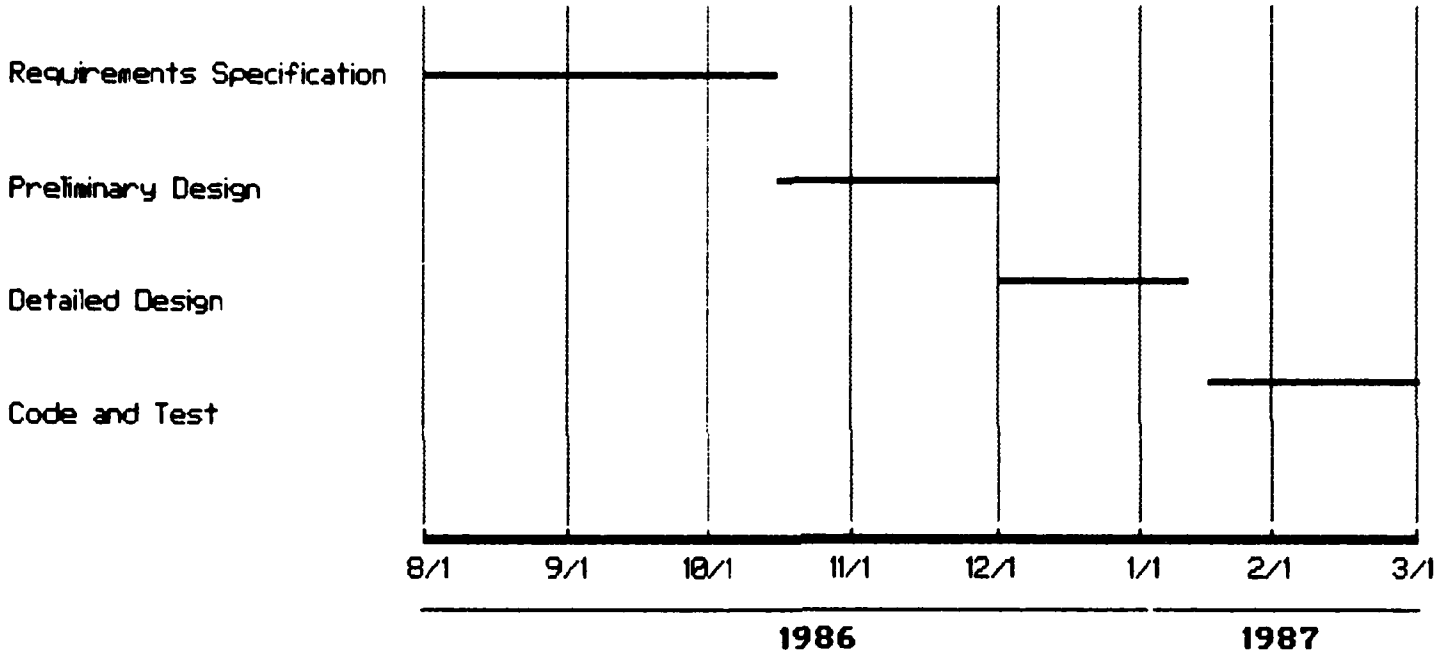
Figure 3.1 shows a proposed schedule for the specification, design, and development of the enhanced NTC database.

3.1 Requirements Specification

The initial step in the database specification process is the formation of an NTC Database Steering Committee (DSC) which will initially be responsible for documenting requirement specifications. At later steps of the development effort the DSC will conduct the Preliminary and Detailed Design Reviews.

The DSC will consist of ARI-POM and BDM personnel with skills in research and data processing, as well as people with relevant military experience. Their charter will be, first, to isolate a comprehensive list of NTC-related research issues, and next, to examine those NTC research issues to identify specific data elements required to satisfy each research objective. There are currently several sources of NTC research issues, including:

(1) The NTC Instrumentation Working Group (NTCIWG),
(2) The ARI-POM Research Plan,
(3) The Performance Measures effort,



NTC Database Development Schedule

Figure 3.1

(4) The Determinants of Performance contract, and
(5) The Shackelford Issues Paper.

In addition to the identification of data elements to be included in the data base, the DSC will also be responsible for some database design considerations such as:

(1) Force level (player, squad, platoon, company, battalion);

(2) Time Frequency of event data (per event, per 5-minute segment, summary for mission segment, summary for all segments);

(3) Position location (PL) data handling (part of event data, per player, per unit, per update, per some arbitrary time period);

(4) Data relationships/ keys (time, player/ unit ID, weapon type).

The primary output of the DSC will be an NTC Requirements Specification Matrix (RSM) which will serve as input to the subsequent preliminary design phase. Figure 3.2 is a sample specification matrix which indicates the kinds of information which will be necessary. A separate RSM will be prepared for each issue identified, after which the DSC will resolve redundancies, ambiguities, and conflicts to prepare an integrated RSM for the database system. During the course of the consolidation, the DSC will necessarily make decisions which will affect the usability of the database by contending research efforts.

After the DSC has reached agreement on all data elements to be included in the database, the consolidated RSM for the entire database will be made available to CATA for review and comments and for use in an IPR which will be conducted as part of the review process. After the review has been completed and the RSM has been modified by the DSC to incorporate critical changes, the specification phase will be considered complete, and the design phase can commence.

In addition to the RSM, the first draft of the NTC Data Handbook will be prepared during the specification phase. This document will provide complete and up-to-date documentation of all NTC digital data sources. The handbook will be completed, as far as the database development is concerned, during the Preliminary Design. The long-term plan is to maintain the NTC Data Handbook as the single source of information concerning NTC digital data.

3.2 Preliminary Design

The second task is the preliminary software design for all software which will create the NTC database as well as the user

Research Issue	Data Element Description	Level	Suggested Frequency	Key(s)	Source	Anticipated Duration	NTCDRS
Tanks in Defense	Position/ location	Player	All	Time Player ID	CIS log	Mission	Yes
Tanks in Defense	Fire Events	Player	All Tanks, TOWs, SAGGER	Time, Player ID	CIS log	Mission	Yes

NTC Database Requirements Specification Matrix

Figure 3.2

interface to the system. Beginning with the specification produced during the previous step, the preliminary design:

(a) Completes the data structure design, including the documentation of all data elements and their relationships;

(b) Allocates all functions to software modules and creates pseudo-code for the control routines; and

(c) Documents specific user interfaces, including menu and screen layouts.

The completion of the preliminary design, coinciding with a Preliminary Design Review (PDR) conducted by the Database Steering Committee, constitutes a necessary "freeze" on the database design in order to allow completion of the detailed design and implementation without delay, and without corrupting the basic design of the system. A second IPR will be conducted following the PDR.

There are two products associated with the preliminary design. The NTC Data Handbook, discussed above, will be completed during the preliminary design. The Preliminary Design Document will consist of five sections, as shown in the sample table of contents included as Figure 3.3.

3.3 Detailed Design

The final step preparatory to coding is the detailed design, which includes the following activities:

(a) Generation of pseudo code for all software modules. The use of a natural-language pseudo code allows the preliminary design to be "coded" without imposing computer language-specific rules. Accordingly, the pseudo coded routines can be understood fairly easily, allowing more people the capability to verify the logical construction of the software. Finally, the pseudo code will remain a permanent part of the source code, supplying a high level of internal documentation.

(b) Completion of the data structures in the target language. This includes all data specification, including COMMON blocks, local variables, passed parameters, data initialization, data base table structures and relations.

(c) Preparation of the draft Users' Manual. The initial version of the users' manual will be prepared as the design details are being finalized, allowing the end users to begin familiarization early in the game.

At the end of the detailed design, a Critical Design Review (CDR) will be conducted by the DSC to ensure that the design fully satisfies the requirements, as documented in the

Preliminary Design Document
Table of Contents

I. Introduction

II. Program Description

III. Program Structure

- A. Program Flow
- B. Major Routines
  - 1. Description
  - 2. Logic Documentation (Program Description Language - PDL)

IV. Data Structures

- A. Description
- B. Table Layouts
  - 1. Data Elements, Keying strategies
  - 2. Inter-Table Relationships

V. User Interface

- A. Description
- B. Menu Layouts

Figure 3.3

specification, and the preliminary design. The final IPR of the specification/design phases will take place following the CDR.

Documentation at the conclusion of the detailed design phase will consist of pseudo-code for all program segments, documentation of the implementation of all data structures, and the initial draft of the Users' Guide. A sample table of contents for the Detailed Design Document is included as Figure 3.4.

3.4 Code and Test

The final developmental step is the translation of the pseudo code generated in the detailed design to code, integrating the code with the data structures, and testing the completed system. Coding and testing will be accomplished in a top-down fashion, with the higher-level routines being completed first, using "stubs" for uncompleted low-level routines, where necessary. Integration will be accomplished at the same time, so that at the end of the coding effort, the NTC database system will be an integrated and fully tested product.

There are two deliverables associated with the coding phase: the NTC Database System, ready for use by the research staff, and the final version of the users' guide.

4.0 Conclusion

This plan covers the period of time and associated effort required to develop a new, more useful and usable, NTC Research Database to support current and projected research by ARI and other interested agencies. The enhanced utility of the database will be derived from the requirements specification effort, during which the database system specification will be driven by the research projects that must be supported by the system. The enhanced usability will come from a redesigned user interface that will make the system possible to use with a minimum of training.

It should be emphasized that the effort discussed includes only the development of the database system; it does not address the significant time and effort necessary to load NTC data into the system. Accordingly, completion of the database system development does not signal the beginning of its useful life, but only the inception of a concentrated effort to make the system pay dividends by loading it with NTC data and using it for the research objectives for which it was designed.

Detailed Design Document
Table of Contents

Figure 3.4